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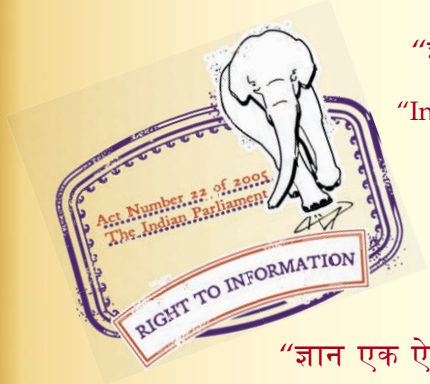

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Indian Standard

GUIDELINES FOR ALLOCATION OF COST AMONG DIFFERENT PURPOSES OF RIVER VALLEY PROJECTS

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110001

April 1975

Indian Standard

GUIDELINES FOR ALLOCATION OF COST AMONG DIFFERENT PURPOSES OF RIVER VALLEY PROJECTS

River Valley Projects, Estimates and Progress Reports Sectional Committee, BDC 50

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Indian Standard

GUIDELINES FOR ALLOCATION OF COST AMONG DIFFERENT PURPOSES OF RIVER VALLEY PROJECTS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 7 November 1974, after the draft finalized by the River Valley Projects, Estimates and Progress Reports Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The allocation problem is a natural concomitant of a multi-purpose project. A multi-purpose river valley project seeks the simultaneous achievement of a number of objectives, such as irrigation, power, flood control, navigation, water supply, sanitation, recreation, etc. The main object of allocation is to distribute the cost on equitable basis amongst various purposes usually to determine the sale price of power or water, or to assess the amount of betterment levy to be imposed in case of irrigation or cess for flood control or other benefits.

0.3 This subject is extremely complicated and it must be accepted at the outset that no universal agreement has yet been reached between the views of the various committees and other authorities who have studied it. No two cases are alike and each must be considered on its merits. Experience has also shown that this complex problem of allocation of cost of multi-purpose river valley project, especially, when it involves inter-state interests and benefits to a government department *vis-a-vis* an autonomous agency leads to endless polemics and consequent delay in clearance of even essential projects. This results in retardation of natural developmental activities and growth. This standard lays down broad guidelines for allocation of costs amongst various purposes/functions of a project.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the practices prevailing in different countries in addition to relating it to the practices in this field in this country. This has been met by deriving assistance from the following publications:

BENNETT (N B). Cost allocation for multi-purpose water projects. Paper 961-Journal No. IR 2 of May 1956, Irrigation and Drainage Division. Proceedings of the American Society of Civil Engineers

PAFFORD (R J). Jr & Charles A. Cocks. Cost allocation for Missouri river main stem reservoir. R 4 Question 15; Transactions. Volume II. 1963. International Commission on Irrigation and Drainage — 5th Congress. Tokyo

ASCE. AMERICAN SOCIETY OF CIVIL ENGINEERS. Amalio Gomez. Cost allocation of water projects in California. Proceedings of Vol 87 No. HY 2 March 1961 — Part I

INTER AGENCY COMMITTEE ON WATER RESOURCES — USA — Proposed practice for economic analysis of river basin projects prepared by the Subcommittee on Evaluation Standards. May 1958

THE PRESIDENT'S WATER RESOURCES COUNCIL — USA — Policies, standards and procedures in the formulation, evaluation and review of plans for use and development of water and related land resources. May 1962

DEPARTMENT OF THE ESTIMATING — OFFICE OF THE CHIEF ENGINEERS — USA — Seminar on river basin planning 27-31 May 1963

DEPARTMENT OF STATE — AGENCY FOR INTERNATIONAL DEVELOPMENT — USA — Benefit — Cost evaluation as applied to AID financed water or related land use projects. — Supplement No. 1 Feasibility studies — economic and technical soundness analysis — Capital Projects May 31 1963

L. DOUGLAS JAMES AND ROBERT R. LEE — Economics of water resources planning — Mc Graw-Hill Book Company. 1971

USBR. Manual on cost allocation release No. 2 Vol XIV. November 1948

RANSMEIR (J S). A case study in the economics of multiple purpose stream planning. The Tennessee Valley Authority. The Vander Hilt University Press Nashville. 1942

DHIR (R D) and SHARMA (B D). Cost allocation in multi-purpose projects. (Paper presented at the seventh Irrigation & Power Seminar, Bangalore). Central Water & Power Commission. India

EDWARD KUIPER. Water resources project economics. Butterworth, London. 1971

CBIP. CENTRAL BOARD OF IRRIGATION AND POWER. INDIA. Working paper for discussion on allocation of costs of multipurpose projects to various beneficiaries and between various purposes of the project. November 1970

1. SCOPE

1.1 This standard enumerates various methods for allocation of cost among different purposes/functions of river valley projects and general principles for selection of the most suitable method.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Allocation of Cost — Allocation of cost may be defined to mean apportionment or sharing of project cost among the various purposes/functions that will be served by the multi-purpose project.

Allocation of project casts may be desired for various administrative purposes. It is usually necessary when public policy requires that charges for all or certain products or services of the project shall be based upon cost incurred therefor.

2.2 Alternative Cost — The alternative cost for each purpose may be defined as the lowest cost of achieving the same or equivalent benefits in single purpose structure that will accrue to each purpose in the multi-purpose structure. The alternative should be real in the sense that it can be built, and if built would produce equivalent benefits. It may, however, be entirely different in physical plan. The alternative need not be limited to water resources development project; for example, for power generation a steam plant can be used, affording equivalent benefits if it is found to be the least costly one. The alternative may be figured near the site of the multi-purpose project.

2.3 Alternative Justifiable Cost (Expenditure) — The cost of obtaining an equivalent benefit from the most economical alternative single-purpose project available, provided such cost does not exceed the market value of the service rendered.

2.4 Benefits — Beneficial effects of a project should be assigned monetary values by directly applying projected market prices or derived prices based on projected costs of production by alternative means.

2.5 Cost — Project costs include the initial investment in land, labour and materials and subsequent costs for replacements and for operation and maintenance. Costs of post-authorization investigations, interest during construction, engineering, inspection, administration, and overhead in general should be included. Also included are casts induced by the project even when actual compensation is not involved. Project costs should be evaluated in terms of prices expected to be applicable at the time costs are incurred. As in the case of benefits, project costs should be converted to a common time basis.

2.6 Function — An important service performed by a multi-purpose project; also, that which renders such services.

2.7 Joint Cost (Common Cost/Distribution Cost) — Joint costs are the costs of identifiable physical facilities which serve more than one purpose/function (e. g. dam, reservoir in a multi-purpose project). They are the residual costs representing the difference between the cost of the multiple-purpose project as a whole and the total of the specific/separable costs for all project purposes/functions.

If the total separable costs of all purposes should exceed the cost of the multi-purpose project, there are in effect no residual costs, but rather a joint saving, which can be distributed among purposes/functions by reducing separable costs to obtain the allocation to each purpose/function instead of by adding a portion of residual costs to each separable cost. When the estimates of separable cost cannot be made or are difficult to make, joint costs may be considered to be the difference between the cost of the multi-purpose project and the sum of the specific cost for each purpose/function.

The joint costs are allocated to each purpose/function and the sum of the allocated joint costs and separable/specific costs gives the total allocation to a purpose/function.

2.8 Justifiable Cost — The benefit accruing to a particular purpose or the cost of an alternative project, whichever is less.

2.9 Project — Project may be defined as any separable integral physical unit of several components and closely related units or features or system of measures undertaken or to be undertaken within a specific area for the control and development of water and related land resources, which can be established and utilized independently or as an addition to an existing project, and can be considered as a separable entity for the purpose of evaluation.

2.10 Remaining Alternative Cost — The difference between justifiable alternative of each function and the specific cost.

2.11 Remaining Benefit — The difference between the justifiable expenditure and the separable cost. The remaining benefits will usually be smaller than remaining alternative cost.

2.12 Separable Cost — The separable cost for each project purpose/function is the difference between the cost of the multi-purpose project and the cost of the project with that purpose/function omitted. Separable costs include specific costs together with any other additional project cost attributable to the inclusion of the given purpose/function.

In calculating separable cost each purpose/function should be treated as if it were the last increment of multi-purpose project. This calculation

will show the added cost of increased size of structures and changes in design necessary for introducing a particular purpose/function, such as the cost of increasing the reservoir storage capacity. (In those cases, where the calculations of separable cost may be unduly burdensome, the specific costs may be used).

2.13 Specific Cost (Executive Cost) — The cost of that portion of the project which is built for exclusive use of a purpose. Thus the cost of canal headworks and distribution system is the specific cost for irrigation. The cost of power plant, sub-station, transmission lines, etc, is specific cost for power and so on.

2.14 Vendibility — The value in the market of the services rendered by a project function, expressed as an annuity.

3. BASIC PRINCIPLES FOR ALLOCATION OF COST

3.1 The use of one structure to provide more than one service makes possible the provision of services at less than the total cost of separate structures for each service. This being so, the basic principle for cost allocation is that the savings derived through the use of the combined structure for numerous purposes should be shared equitably by these purposes. Cost allocation is, therefore, the process of apportioning the cost of a multi-purpose project equitably among the several purposes served. The cost of a multi-purpose project includes the specific or separable cost of individual features which serve only a single purpose and joint cost of the features which serve several purposes. In allocating costs, first the total separable or specific cost should be allocated to the respective purpose and then the joint (total remaining) cost of the project should be allocated among the purposes served in such a way that each will share equitably in the savings or economics resulting from the joint cost. Equitable distribution of these costs may be effected by preventing cost allocated to any purpose from exceeding corresponding benefits; by requiring each purpose to carry at least its separable cost; within these maximum and minimum limits by providing for proportional sharing of the savings resulting from the multi-purpose development. The central problem is the division of joint cost for all structures which produce several kinds of services. The difficulty involved in this problem can be minimized by arriving at the smallest possible figure of the joint cost.

3.1.1 The basic principle, therefore, to ensure equitable allocation to the various purposes is that the cost allocated to a purpose should be:

a) not more than the benefits to be achieved by that purpose,

b) not more than the cost of an alternative project built for that purpose alone, and

c) not less than the cost of the items meant for the specific (exclusive) use of that purpose.

Besides the above three basic principles, due consideration should be given to the national priority or urgency of any purpose over others at the time of formulation of the project or subsequent review.

3.2 Common Allocation Procedures — The different methods for cost allocation generally have a common procedure described below in four steps:

a) To determine specific costs which serve each of the purposes;

b) To assign such specific costs to various purposes from the capital cost and to find out the remaining joint cost;

c) To distribute joint cost equitably to various purposes; and

d) To sum up, for each purpose, the specific cost and the share of joint cost chargeable to that purpose.

4. METHODS FOR COST ALLOCATION

4.1 Current Methods

4.1.1 Although many methods for allocation of costs have been devised the following are well known amongst them:

a) Alternative cost method,

b) Alternative justifiable cost method (AJC method),

c) Bearability concept,

d) Benefits methods,

e) Ceiling allocation method,

f) Equal apportionment method,

g) Separable costs — Remaining benefit method (SCRB method),

h) Use of facilities method, and

j) Vendibility method.

4.2 Brief Descriptions of Methods

4.2.1 *Alternative Cost Method* — In this method, the alternative cost of a new single purpose project is split up into two parts, namely, the specific cost equal to that in the multi-purpose project, and the balance. The joint cost of the multi-purpose project is then distributed in the ratio of the balance. The allocated joint cost is then added to the respective specific cost to arrive at the total cost allocated to each function.

4.2.2 *Alternative Justifiable Cost Method* — This method is similar to the alternative cost method, the only difference being that the specific cost is subtracted from the justifiable cost. The joint cost is then distributed in the ratio of the balance as in the alternative cost method and the cost allocated

to each purpose/function is worked out by adding the respective specific cost to the allocated joint cost.

4.2.3 *Bearability Concept* — This concept suggests that the net revenue from the minor advantage (gross revenue minus the operation, maintenance and depreciation on both the specific cost and share of the joint cost of the minor advantage) shall be equal to the interest charges on the capital investment on the minor advantage, both specific cost and share of joint cost chargeable to the minor advantage.

4.2.4 *Benefits Methods* — In this method, the cost is allocated to each function by its specific cost plus a share of the joint cost in direct proportion to the estimated net benefits accruing to that function.

4.2.5 *Ceiling Allocation (or Priority of Use) Method* — In a multi-purpose project the various purposes to some extent compete with each other for the use of the water or storage space. The functions have different timing for the periods for optimum storage and release of water and thus all of them cannot be served in an optimum manner.

If some of the functions are served proportionately more than others, the priority of use method will give special consideration to such priorities.

The priority of use method assigns the specific cost entirely to the individual purpose and assigns the remaining joint costs to project purposes in a descending order of priority. Thus, the top priority purpose is charged with joint costs equal to the lesser of two amounts, namely:

a) the benefits minus specific costs assigned to that purpose, or

b) the cost of the most economical alternative minus specific costs assigned to that purpose.

The remaining joint costs are then allocated in the same manner to the other functions in order of priority. In this way, the higher priority functions are assigned the maximum allocation represented by alternative joint cost for these purposes, thereby relieving the lower priorities from sharing the joint costs.

4.2.6 *Equal Apportionment Method* — In this method, the joint cost is distributed equally among the different purposes served by multi-purpose project. It is based on an arbitrary assumption that an equal portion of the joint cost is reasonably chargeable to each of the purposes.

4.2.7 *Separable Cost — Remaining Benefits Method (SCRB Method)* — The basic principle of distribution in this method is the same as in the alternative justifiable cost method. It may, however, be said to be a refined form of that method in so far as the concept of specific cost for each purpose is replaced by the concept of separable cost. Separable cost for each purpose is subtracted from the justifiable cost and the remainder which is really the

' remaining alternative cost ' is termed, in this method, as the ' remaining benefits ' for the purpose. The joint cost (which in this case is the difference between entire project cost and the sum of separable cost) is, then, distributed in the ratio of remaining benefits for each purpose/function. When separable cost for all purposes/functions consists of specific cost only the separable cost — remaining benefits method is identical to the alternative justifiable cost method in computation and results.

4.2.8 *Use of Facilities Method* — This method is based on the premise that the joint costs should be proportioned among the various functions according to their amount of use of the joint facilities. There are usually two approaches for assessing the use for each purpose. They are the ' capacity approach ' and the ' water-released approach '.

In the ' capacity approach ', the joint cost is distributed in the ratio of storage assigned to different purposes, whether or not those storages are actually used. Two or more purposes may make use of the same reservoir capacity alternately or simultaneously. For instance, a part of flood waters as stored may be used for irrigation purposes. This storage, would then be included both for flood control and irrigation. Similarly, power storage may be utilized for irrigation, after the water has passed through the power house. In the ' water-released approach ', the joint cost is distributed in the ratio of total quantity of water released for each purpose. For instance, a part of flood waters as stored may be utilized for irrigation or to maintain the minimum depth for navigation or to produce secondary power. The total quantity of water in a flood season may be greater than the capacity of the storage space for the purpose. Thus, an estimate has to be made of the total quantity of water that may have to be held back in order to ensure flood protection to damage centres downstream keeping in view the average flow conditions downstream of the reservoir. Similarly, a portion of water released from the power house may be utilized for irrigation, in addition to that for exclusive storage for irrigation. The total quantity of water likely to be released in the interest of each purpose has, therefore, to be estimated. The joint cost is then distributed in proportion to the total quantity of water released for each purpose.

4.2.9 *Vendibility Method* — The vendibility theory assumes that the products of a multi-purpose project are sold in an entirely free competitive market. The method assumes that the revenues from all benefits of a multi-purpose project shall at least be equal to the total cost of the project. The revenues of each benefit should be sufficient to cover the specific costs and in addition should contribute towards the joint cost in such a manner as to render the entire project remunerative with revenues realized from each of the benefits at competitive prices. In this method, a particular purpose, the revenues from whose benefits are not sufficient to meet its costs are subsidized by other purposes the benefits from which are produced at more competitive price.

The method of dividing joint cost is as follows:

a) The specific cost is subtracted from the estimated revenues for that purpose,

b) The remainder is captalized at the prevailing rate of interest, and

c) The remainder is the share of the joint cost or is the upper limit of the share of the joint cost for this particular purpose.

4.3 Examples — Typical examples illustrating the steps involved in these methods are given in Appendix A.

5. SUITABILITY OF THE VARIOUS METHODS

5.0 The use of any one of these methods is not strictly governed by a set of conditions under which each method is applicable. Actually, the selection is governed by the fact whether a particular method satisfies the broad and basic principles detailed in **3** and whether it ensures the most equitable allocation of cost to various purposes/functions of a multi-purpose project. As no method is suitable for all the conditions and that different methods have to be used for different components in a complex system, the set of conditions under which each method has been generally found suitable has been described in the following clauses to provide guidance to the user.

5.1.1 *Alternative Cost Method* — This method gives no consideration as to whether the single-purpose project is itself economical or not and may be used when this consideration is not of significance. If the alternative is an uneconomical one (that is, if the cost-benefit ratio is more than unity) the alternative is itself unjustified and the method becomes unsuitable. It will thus be seen that while this method satisfies conditions (b) and (c) it does not satisfy condition (a).

5.1.2 *Alternative Justifiable Cost Method* — The alternative justifiable cost method meets the shortcomings of both the benefits method and the alternative cost method by utilizing the lesser of the two values, namely, that of the benefits or of the most economical alternative cost, for purposes of distribution of joint cost. The method, therefore, satisfies all the three basic conditions.

The method assumes that the benefits as well as the cost of alternative single-purpose project may be determined fairly accurately. It is tedious to work out all alternatives yielding the same benefits. For instance, in a flood control alternatives, possibilities of embankments, channel improvements, diversions, etc, yielding the same benefits have to be explored, which would be extremely difficult.

5.1.3 *Bearability Concept* — This takes into consideration the fact that the cost allocation of the project should also be so oriented that the major part of the cost goes to that function of the project which may pay it back

without undue strain. For application of this method, correct evaluation of benefits in monetary terms from the minor advantage should be possible.

5.1.4 *Benefits Method* — The method requires that the benefits be measured on a comparable basis. Since adequate methods of evaluating benefits of some functions have not yet been developed, and since difference in the nature of benefits derived from the various functions creates problems of duplication and non-comparability, monetary benefits are not always a reliable measure of the relative importance of various purposes. The determination of what constitutes usable benefits is often subject to controversy. This method satisfies the conditions (a) and (c), but does not fulfil the requirements of condition (b) in **4.2.9**.

5.1.5 *Ceiling Allocation Method* — This method has the advantage of taking cognisance of gaps in urgency of the participating purposes, thus the less urgent purpose gets the advantage of having to share a lesser part of the joint cost. In some cases, purposes which might have otherwise proved to be uneconomical may be put through by joining hands with purposes of higher priority and sharing cost on the basis of this method.

The method, however, suffers from the deficiency that the purpose with secondary urgency does not necessarily, in all cases, get a proportionately smaller share of the total or joint cost. The use of specific costs in places of separable costs is also likely to result in a comparatively less accurate assessment of joint cost. The method satisfies all the three basic conditions within the limitations mentioned above.

5.1.6 *Equal Apportionment Method* — This method is largely a working rule for the sake of simplicity and ease of calculations. This method should be avoided unless none other logical methods may be applied. This method may be applied when the cost of alternative single purpose projects, the benefits and the savings accruing to each of the purposes are almost equal. This procedure does not satisfy any of the conditions except (c).

5.1.7 *Separable Costs — Remaining Benefit Method* (*SCRB Method*) — This approach to cost allocation results in a more equitable distribution of project cost. It introduces a refinement in reducing the amount of joint cost that is to be distributed by utilizing values of separable costs instead of specific costs, the joint cost is reduced, thereby correspondingly reducing chances of dispute or error in the ultimate distribution of cost. This method, however, is laborious in that separable costs for all the participating purposes are to be separately assessed. In this method all the three basic conditions are satisfied.

5.1.8 *Use of Facilities Method* — While this method has the merit of attempting to allocate the joint cost on the basis of use of the waters for each purpose of the project, it suffers from the deficiency that there is no upper limit to allocation in relation to either benefits or an alternative justifiable cost. Although the two common measures of use are the storage

capacity and the quantity of water released, at one extreme, flood control is directly related to the capacity of reservoir to store water and at the other extreme, the irrigation is primarily dependent on the volume of water released. The water release approach is not an entirely satisfactory method if the water is released for more than one use. If the 'capacity approach' is used, it neglects the dynamic variations and so may fail to measure the reasonable use by the function of the project. If the two approaches could be satisfactorily reconciled in one single method, the use of facilities method would be of far greater value.

It satisfies all the three basic conditions mentioned in **4.2.9**. It is, however, useful in making sub-allocation on the simple basis of a proportionate use of a given facility as measure in physical terms, such as the division of the cost of canal between municipal water and irrigation water.

5.1.9 *Vendibility Method* — This method is not usually applied to public works, the benefits from which are generally not offered for sale in the open market, as in the case of private business under conditions of perfect competition. The method does not satisfy any of the conditions except (b).

6. REVIEW OF THE ALLOCATED COST

6.1 Allocation of cost which may be fair to all purposes concerned at a particular time will perhaps be manifestly unfair to some with the passage of time. All cost apportionment should therefore be subject to periodic review to enable appropriate adjustments to be made in the light of changed circumstances.

APPENDIX A

(*Clause* 4.3)

EXAMPLES FOR THE COST ALLOCATION BY VARIOUS METHODS

ASSUMPTIONS

A-1. COST ALLOCATION

A-1.1 Basic Data

	Rs in Lacs
1) Capital outlay	16 200
2) Specific cost:	
Irrigation	28
Power	4 073

3)	Joint cost [16 200 — (4 073 + 28)]	12 099
4)	Irrigation benefits	6·47 lac ha
5)	Power benefits:	
	Energy	$2\,933{\cdot}6 \times 10^6$ kWh
	Capacity	600 MW
6)	Annual gross revenue on power @ 5·5 p/kWh at bus bars	1 581
7)	Annual revenue on additional irrigation of 6·47 lacs ha @ Rs 33·69 per ha	218
8)	Cost of the alternative power generation scheme for affording equivalent benefits installation of 600 MW power plant @ Rs 2 500 per kW	15 000
9)	Cost of the alternative irrigation scheme for affording equivalent benefits irrigation of 6·47 lacs ha @ Rs 2 040 per ha (for storage works)	13 200
10)	Annual specific cost:	
	Irrigation:	
	Interest @ 6·5% $\left(28 \times \frac{6{\cdot}5}{100}\right)$ = 1·82	
	Depreciation @ 1·5% $\left(28 \times \frac{1{\cdot}5}{100}\right)$ = 0·42	
	O & M @ 0·5% $\left(28 \times \frac{0{\cdot}5}{100}\right)$ = 0·14	2·38
	Power:	
	Interest @ 6·5% $\left(4\,073 \times \frac{6{\cdot}5}{100}\right)$ = 264·75	
	Depreciation @ 2% $\left(4\,073 \times \frac{2}{100}\right)$ = 81·46	
	O & M @ Rs 10/kW/year = 60·00	406·21

11) Annual cost of alternative power generation scheme

Interest @ 6·5%

$$\left(15\,000 \times \frac{6{\cdot}5}{100}\right) = 975{\cdot}75$$

Depreciation @ 2%

$$\left(15\,000 \times \frac{2}{100}\right) = 300$$

O & M @ Rs 10/kW/year for 600 MW = 60

Fuel @ 5p/kWh for generation of

$$\frac{2\,933{\cdot}6 \times 10^6}{0{\cdot}92}\ \text{kWh} = 1\,595$$

2 930·0

12) Annual cost of alternative irrigation scheme

Interest @ 6·5%

$$\left(13\,200 \times \frac{6{\cdot}5}{100}\right) = 858$$

Depreciation @ 1·5%

$$\left(13\,200 \times \frac{1{\cdot}5}{100}\right) = 198$$

O & M @ 0·5%

$$\left(13\,200 \times \frac{0{\cdot}5}{100}\right) = 66$$

1 122·0

A-1.2 Alternative Cost Method

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Alternate annual cost	1 122	2 930	
ii)	Annual specific cost	2·38	406·21	
iii)	Difference [(i) — (ii)]	1 119·62	2 523·79	3 643·41
iv)	Proportion (%)	30·6	69·4	
v)	Share of joint cost [12 099 × (iv)]	3 700	8 399	12 099
vi)	Specific cost	28	4 073	4 101
	Total allocation	3 728	12 472	16 200

A-1.3 Alternative Justifiable (Expenditure) Method

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Annual benefits	218	1 581	
ii)	Alternative annual costs	1 122	2 930	
iii)	Justifiable expenditure [Lesser of (i) or (ii)]	218	1 581	
iv)	Annual specific cost	2·38	406·21	
v)	Remaining justifiable expenditure [(iii) — (iv)]	215·62	1 174·79	1 390·43
vi)	Proportion (%)	15·5	84·5	
vii)	Share of joint cost [12 099 × (vi)]	1 875	10 224	12 099
viii)	Specific cost	28	4 073	4 101
	Total allocation	1 903	14 297	16 200

NOTE — Separable cost — Remaining Benefits Method is similar to the above method excepting that the specific costs are replaced by separable costs.

A-1.4 Benefit Method

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Annual benefit	218	1 581	1 799
ii)	Proportion (%)	12·0	88	
iii)	Share of joint cost [12 099 × (ii)]	1 452	10 647	12 099
iv)	Specific cost	28	4 073	4 101
	Total allocation	1 480	14 720	16 200

A-1.5 Ceiling Allocation Method or Priority of Use Method (Assuming that Irrigation is of Primary Urgency)

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Annual benefits	218	1 581	
ii)	Alternative annual cost	1 122	2 930	
iii)	Alternative justifiable cost [lesser of (i) or (ii)]	218	1 581	
iv)	Annual specific cost	2·38	406·21	
v)	Remaining alternative cost [(iii) — (iv)]	215·62	1 174·79	
vi)	Share of joint annual cost*	215·62	789·79	1 005·41
vii)	Proportion (%)	21·4	78·6	
viii)	Share of joint cost [12 099 × (vii)]	2 590	9 509	12 099
ix)	Specific cost	28	4 075	4 101
	Total allocation	2 618	13 582	16 200

*Annual cost:

	Rs in Lacs
Interest @ 6·5% $\left(16\,200 \times \frac{6{\cdot}5}{100} \right)$	1 050
Operation and maintenance	110
Depreciation	254
Annual specific cost	1 414
(2·38 + 406·21)	408·59
Joint annual cost (1 414 — 408·59)	1 005·41

A-1.6 Equal Apportionment Method

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Specific cost	28	4 073	4 101
ii)	Share of joint cost	6 049·5	6 049·5	12 099
	Total allocation [(i) + (ii)]	6 077·5	10 122·5	16 200

A-1.7 Vendibility Method

Sl No.	*Item*	*Irrigation*	*Power*	*Rs in Lacs Total*
i)	Revenues	218	1 581	
ii)	Annual specific cost	2·38	406·21	
iii)	Difference [(i) — (ii)]	215·62	1 174·79	1 390·41
iv)	Proportion (%)	15·5	84·5	
v)	Share of joint cost [12 099 × (iv)]	1 875	10 224	12 099
vi)	Specific cost	28	4 073	4 101
		1 903	14 297	16 200

A-2. BEARABILITY CONCEPT

A-2.1 Data

a) Total cost of the project — 9 970 lacs
b) Revenue from irrigation — 68·96 lacs
c) Operation and maintenance of irrigation canals — 15·32 lacs
d) Cost of irrigation channels — 974 lacs
e) Specific cost for irrigation — 140 lacs
f) Betterment levy is Rs 100 per hectare
g) Total land under betterment levy 520 000 hectares giving — 520 lacs
h) Rate of interest on capital investment @ 4·5% per year simple interest
j) Joint cost — 5 785 lacs
k) Average rate of depreciation, operation and maintenance for items of joint cost is — 44·87 lacs

A-2.2 Net revenue from irrigation is 68·96 — 15·32 = 53·64 lacs

Assume that the share of joint cost chargeable to irrigation as 500 lacs

Depreciation, operation and maintenance on 500 lacs for the share of joint cost

$$= \frac{44{\cdot}87}{5785} \times 500 = 3{\cdot}88 \text{ lacs}$$

Therefore, net revenue = 53·64 — 3·88 = 49·76 lacs

Capitalized cost at 4·5 percent = $49{\cdot}76 \times \frac{100}{4{\cdot}5}$ = 1 105 lacs

which is nearly equal to the total charge for irrigation which is 1 094 lacs [that is, item (iv) + (v) — (vii) + assumed share of 500 lacs].

Therefore, share of joint cost chargeable to irrigation may be taken as 500 lakhs (exact value may be worked out by successive calculations of capitalized cost).

Therefore, total charge to irrigation is 500 + 140 = 640 lacs

Percentage of project cost chargeable to irrigation is

$$\frac{640 \times 100}{9\,970} = 6{\cdot}4 \text{ percent}$$

A-3. USE OF FACILITIES METHOD

A-3.1 Data

Total cost	= 1 140 lacs
Estimated use (storage capacity)	= 50 000 ha.m for flood control 25 000 ha.m for irrigation 25 000 ha.m for power
Separable cost	= 120 lacs for flood control 500 lacs for irrigation 320 lacs for power

A-3.2 Joint Cost is (Total Cost — Separable Costs) = 1 140 — 940 = 200

For flood control share of joint cost

(in the ratio of use) = $200 \times \frac{50\,000}{100\,000}$ = 100 lacs

For irrigation, share of joint cost

(in the ratio of use) = $200 \times \frac{25\,000}{100\,000}$ = 50 lacs

For power, share of joint cost

(in the ratio of use) = $200 \times \frac{25\,000}{100\,000}$ = 50 lacs

Therefore, total cost of flood control is 120 + 100 = 220 lacs

Total cost of irrigation is 500 + 50 = 550 lacs

Total cost of power is 320 + 50 = 370 lacs

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